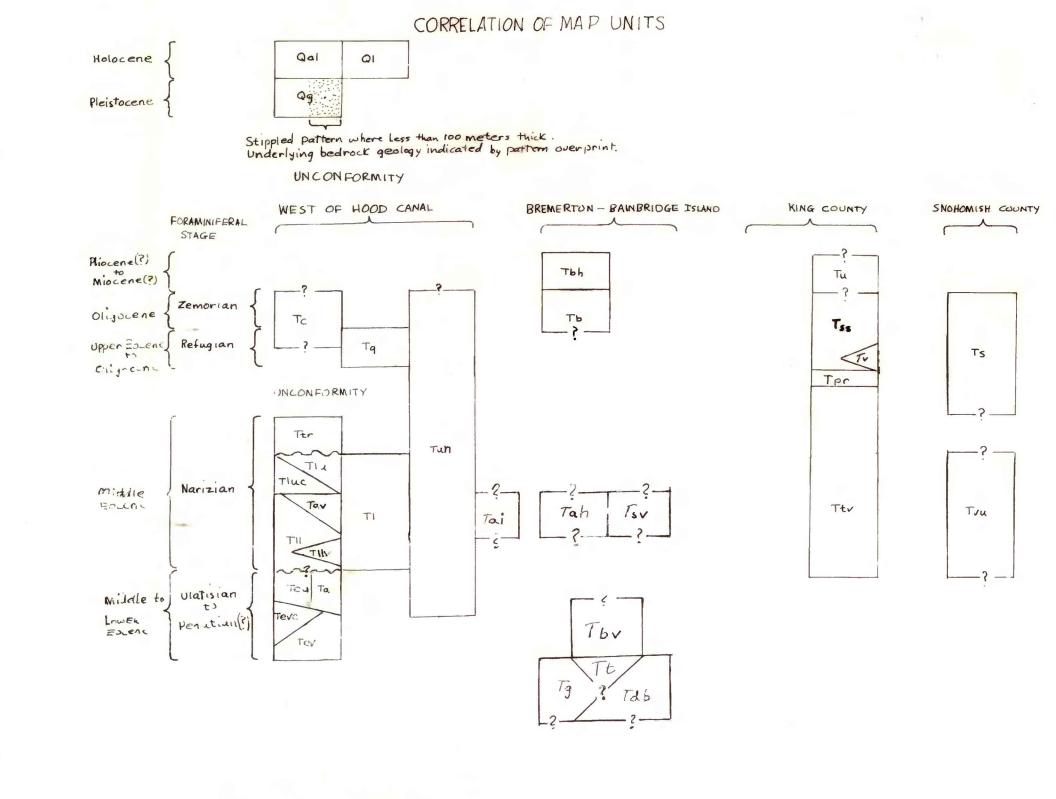
#### **OPEN-FILE REPORT** 91- 147 SHEET 1 OF 4



### **DESCRIPTION OF MAP UNITS**

#### SURFICIAL DEPOSITS

Qal Alluvium (Quaternary)--stream deposits composed of unconsolidated sand, gravel, and silt. Only shown in major drainages on the Olympic and Kitsap Peninsulas

Ql Landslide deposits (Quaternary)--slumped, chaotic debris composed of local bedrock. Arrows show direction of movement Qg Glacial deposits (Quaternary)--till, stratified outwash sand and gravel, and lacustrine clay

and silt. Most of the deposits originated from the Puget Lobe of the continental ice sheet during Fraser glaciation, but also includes deposits from earlier glaciations, and deposits from alpine glaciers in the Olympic Mountains. Underlying bedrock geology is shown by pattern overprint for areas where glacial deposits are less than 100 meters thick

#### **BEDROCK UNITS**

#### UNITS WEST OF HOOD CANAL

Tc Conglomerate (Upper Eocene and Oligocene)--pebble and cobble, massive to thick bedded. Clasts are predominantly chert, with some metasandstone, quartz, and minor gabbro and granite; locally well cemented with calcium carbonate. Unconformably overlies Lyre Formation and older rocks southeast of Port Discovery. Its age and correlation with other rock units are uncertain

Tun Undifferentiated Tertiary Sedimentary Rocks (Lower Eocene through Oligocene?)--fine to very coarse grained semi-friable sandstone with thin lenses of pebble conglomerate containing yellowish gray to white tuff clasts. Age and correlation with other units is uncertain

Tq Quimper Sandstone of Durham (1942) (Upper Eocene)--sandstone, gray to olive gray, weathers to yellowish brown, fine- to coarse-grained, poorly sorted and feldspathic. Most commonly is faintly bedded to massive, but includes some thin bedded to laminated sections, and occasionally is crossbedded. Locally includes siltstone beds up to 12 cm thick, spherical and elliptical calcareous concretions up to 30 cm in diameter, and calcareous lenses up to 4 m long. Also contains rare isolated well-rounded chert pebbles. Unconformably overlies massive basalt flows of the Crescent Formation on the south end of Oak Bay. Marine mollusks collected from this unit were correlated with the Refugian foraminiferal stage and originally assigned as Oligocene age by Durham (1944). The Refugian Stage, however, is now considered to be of

late Eocene age (Poore, 1980)

Ttr Twin River Formation (Middle and Upper Eocene)--sandstone, feldspathic to subfeldspathic, light gray, very fine- to fine-grained, thin to thick bedded; and siltstone, medium gray, commonly sandy, faintly bedded to massive. Locally contains elliptical and spherical calcareous concretions and lenses up to 15 cm thick. Rare thin beds of chert-bearing grit and pebble conglomerate occur locally. Foraminifera from this formation have been assigned to the middle Eocene Narizian Stage by Rau (1979, pers. comm.)

## Lyre Formation (Middle Eocene) divided into:

Tlu Upper part--sandstone, massive to thin bedded, very fine- to medium-grained and pebbly. Also includes pebble and cobble conglomerate, siltstone, and sandy siltstone. Overlies Teve east of Port Discovery

Tluc Conglomerate--pebble to cobble, thick bedded, clasts predominantly chert with minor white to yellowish gray andesite, presumably derived from Tav. South of Snow Creek the basal part of this conglomerate is composed primarily of cobbles and pebbles of porphyritic hornblende andesite

Tll Lower part--conglomerate, sandstone, and siltstone. West of Cedar Flat this unit is predominantly thick bedded to massive conglomerate; to the south the dominant lithology is thin to thick bedded sandstone with minor conglomerate. Conglomerates are composed of well rounded pebbles and cobbles of chert with lesser amounts of metasedimentary and igneous rocks, quartz, and graywacke. The lower part of the unit south of Snow Creek locally includes some angular to rounded basalt clasts. Sandstones are fineto coarse-grained and commonly contain scattered pebbles. Siltstone is sandy and thinly to faintly bedded. Hornblende separates from an andesite boulder in this unit collected just west of the quadrangle boundary, near Mount Zion, yield K-Ar ages of 35.5 and 41.0 my (Table 1),

Tllv volcanic breccia and conglomerate--composed of angular to well rounded basalt clasts TI Lyre Formation undifferentiated (Middle Eocene)--conglomerate, pebble to cobble, thick

bedded to massive, clasts predominantly chert with metasedimentary and igneous rocks, quartz and graywacke Tav Andesite Tuff and Breccia (Middle Eocene)--Andesite and hornblende andesite tuff and breccia, white to light gray. Locally contains rare leaves and coalified wood.

Tai Andesite (Middle Eocene)--pale yellowish brown, porphyritic, intrusive Ta Aldwell Formation (Lower and Middle Eocene)--siltstone, faintly bedded to thin-bedded,

Commonly massive, but some tuffs are thin bedded.

fine- to fine-grained sandstone. No fossils were found in this unit in the map area, but in the Port Angeles-Lake Crescent area to the west the Aldwell Formation has been dated as late early to early middle Eocene (Ulatisian to Narizian Stage, Rau, 1964)

Teu | Sedimentary Rocks, Unnamed (Lower and Middle Eocene) -- sandstone, fine- to mediumgrained volcanic and feldspathic, thin to thick bedded, locally contains rounded shale clasts up to 10 cm long. Convolute bedding is common and groove casts are present at the bases of some beds. Thick sandstone beds show cavernous weathering. Sandstone is interbedded with massive to faintly bedded, dark gray to black siltstone. For aminifer a from north of the quadrangle indicate early to middle Eocene age for these rocks. They have been assigned to the Ulatisian and possibly Penutian foraminiferal stages by Thoms (1959) and Rau (1980, pers. comm.)

## Crescent Formation (Lower Eocene) divided into:

Teve Conglomerate--massive to faintly stratified, well rounded pebble to boulder clasts composed entirely of basalt, commonly highly weathered. The basaltic conglomerate southeast of Moon Lake is tentatively assigned to this unit, but it is poorly exposed and its stratigraphic position is uncertain

Tev Basalt--massive flows and breccia with rare pillow lavas. Some thick flows are columnar jointed. Red oxidized zones at the tops of flows are common and most of this unit appears to have been erupted under subacrial conditions. Upper part of unit at Olele Point includes interbeds of marine siltstone and sandstone containing foraminifera assigned to the Ulatisian foraminiferal stage (Rau, 1980, pers. comm.). Diorite xenoclast 8 km west of quadrangle boundary, in the Big Quilcene River drainage, yields a K-Ar age from hornblende of 53.4 my (Table 1), (Engels and others, 1976)

#### **BREMERTON - BAINBRIDGE ISLAND**

Tbh Blakeley Harbor Formation of Fulmer (1975) (Lower Miocene?)--the upper part of this unit, exposed north of Blakeley Harbor, is massive to thick bedded pebble, cobble, and boulder conglomerate, interbedded with a few thin beds of mudstone, carbonaceous siltstone, coal, and sandstone. Conglomerate clasts are well rounded and composed almost entirely of basalt, but includes minor amounts of metamorphic rocks, graywacke, white vein quartz, chert, and felsic igneous rocks. The basal part of this unit is poorly exposed dark gray carbonaceous siltstone with thin coal layers. The deposits appear to be of nonmarine origin

Tb Blakeley Formation (Upper Eocene and Oligocene)--siltstone and sandy siltstone, tuffaceous, dark to medium gray, fine to coarse grained volcanic rich sandstone, lapelli tuff, and pebble to cobble conglomerate. Conglomerate is composed of well rounded to subrounded andesite and basalt clasts. Most of the Blakeley Formation is of Oligocene age. Foraminifera from this formation have been assigned to the Zemorrian Stage by Fulmer (1975), but it also includes late Eocene foraminifera of the Refugian Stage in the lower part in exposures near Waterman. The base of the formation is not exposed

Volcanic and Plutonic Rocks of Green Mountain (Lower to Upper Eocene) divided

Tsv Silicic volcanic rock--rhyolite porphyry, pink to light pinkish gray, aphanitic groundmass with quartz phenocrysts to 1 mm diameter. Rock commonly flow banded with quartz phenocrysts alined along horizontal to sub-horizontal planes

Tg Gabbro and alkali feldspar granite -- gabbro typically medium- to coarse-grained, dark greenish gray to dark gray, clinopyroxene-bearing. Included is a small unmappable body of medium-grained plutonic rock containing roughly equal proportions of quartz and sodic plagioclase, and described as an alkali feldspar granite by Reeve (1979). This rock outcrops approximately 200 m NE of the summit of Green Mountain

Tah Hornblende andesite--porphyritic, containing fine- to medium-grained plagioclase phenocrysts and common euhedral hornblende. Light to medium gray. Dikes up to 5 m thick intrude Tg, Tdb, and Tbv. K-Ar age of 45.2 my was determined from a hornblende separate from this rock collected approximately 1.2 km south of Kitsap Lake (Table 1), (Snavely, written

Tt | Tonalite--fine-grained, light gray rock containing approximately 30% quartz and 70% sodic plagioclase. Rock weathers to grus

Tdb Diabase and basalt -- sugary textured dark gray green diabase containing numerous aphanitic basaltic dikes. Basalt breccia with angular clasts to 5 cm diameter are contained within the diabase. The basalt is only rarely amygdaloidal and porphyritic and in either case the amygdals and phenocrysts are much smaller than those found in Tby. Locally includes hornblende andesite dikes and, in some areas covered by glacial deposits, probably includes undifferentiated Tg, Ta, and Tt

Tbv Basalt--dark gray, aphanitic, porphyritic, amygdaloidal. Occurs as thick massive subaerial flows that commonly contain red oxidized upper flow surfaces. Vugs, especially near flow contacts, to 1 cm diameter and commonly filled with zeolites. Samples at west end of Sinclair Inlet yield whole rock K-Ar ages ranging from 43.3 to 49.2 my, 40 Ar/39 Ar total fusion ages of 51.7 and 55.3 my, and a <sup>40</sup>Ar/<sup>39</sup>Ar incremental heating age of 55 my (Table 1), (Duncan, 1982). Locally includes hornblende andesite dikes (Tah) and, in areas covered by glacial deposits, may include Tg, Tdb, Ta, and Tt

## KING COUNTY

Tu Nonmarine Sedimentary Rocks (Lower to Upper Miocene)--sandstone, siltstone, claystone, conglomerate, and tuff. Sandstone is tuffaceous, fine- to coarsegrained, light brownish gray to white, friable to semifriable, well sorted, massive to crossbedded, and commonly contains hornblende crystals and minor fine muscovite. Siltstone and claystone are poorly sorted, tuffaceous, light brownish gray, faintly bedded to massive, and locally contain coalified wood fragments. Conglomerate is made up of boulder, cobble, and pebble size clasts with porphyritic andesite the most common rock type. Most tuff beds contain hornblende crystals. Two hornblende splits from the same airfall tuff bed collected mile west of Lake Sammamish yielded K-Ar ages of 9.3 and 14.7 my (Table 1). The unit may be at least in part correlative with the Ellensburg Formation (Tabor and others, 1982b)

Tss Undifferentiated Marine and Nonmarine Sedimentary Rocks (Upper Eocene and Oligocene)--volcanic sandstone, siltstone, claystone, and lapelli tuff. Sandstone is yellow to yellowish white, weathers to reddish brown, poorly sorted fine- to very coarse-grained, contains abundant tuff, pumice, and chert clasts, is massive to well bedded, ocassionally crossbedded and is well indurated to semifriable. Contains some pebble conglomerate beds up to 10 cm thick made up of well rounded felsic volcanic clasts. Siltstone is tuffaceous, light gray, and massive and locally contains rare calcareous concretions up to 10 cm in diameter. Some thin bedded sandstone and fragments. Although most of this unit is marine, it also includes carbonaceous shale and coal-bearing nonmarine strata south and east of Lake Sammamish. The upper part of this unit contains Zemmorian Stage foraminifera (Rau, 1980, pers. comm.) and is correlative with the Blakeley Formation on Bainbridge Island. The lower part of the unit contains Refugian Stage foraminifera of late Eocene age (Rau, 1980, pers. comm.). In the Renton area, similar rocks have been tentatively correlated with the Lincoln Creek Formation of southwest Washington (Mullineaux, 1970)

Tv Mafic Volcanic Rock (Upper Eocene and Oligocene)--basalt breccia, flows, and minor basaltic sandstone. Black and dark gray, weathering to brown and light gray. Intertongues with Tss

## Puget Group (Middle and Upper Eocene):

Tpr Renton Formation (Upper Eocene)--sandstone, light gray to white, fine- to mediumgrained, micaceous, feldspathic to arkosic, crossbedded to massive, interbedded with carbonaceous siltstone, coal, and claystone. The formation is nonmarine. No fossils have been found in the Renton Formation in the man area but its age is well established as late Eocene because both the

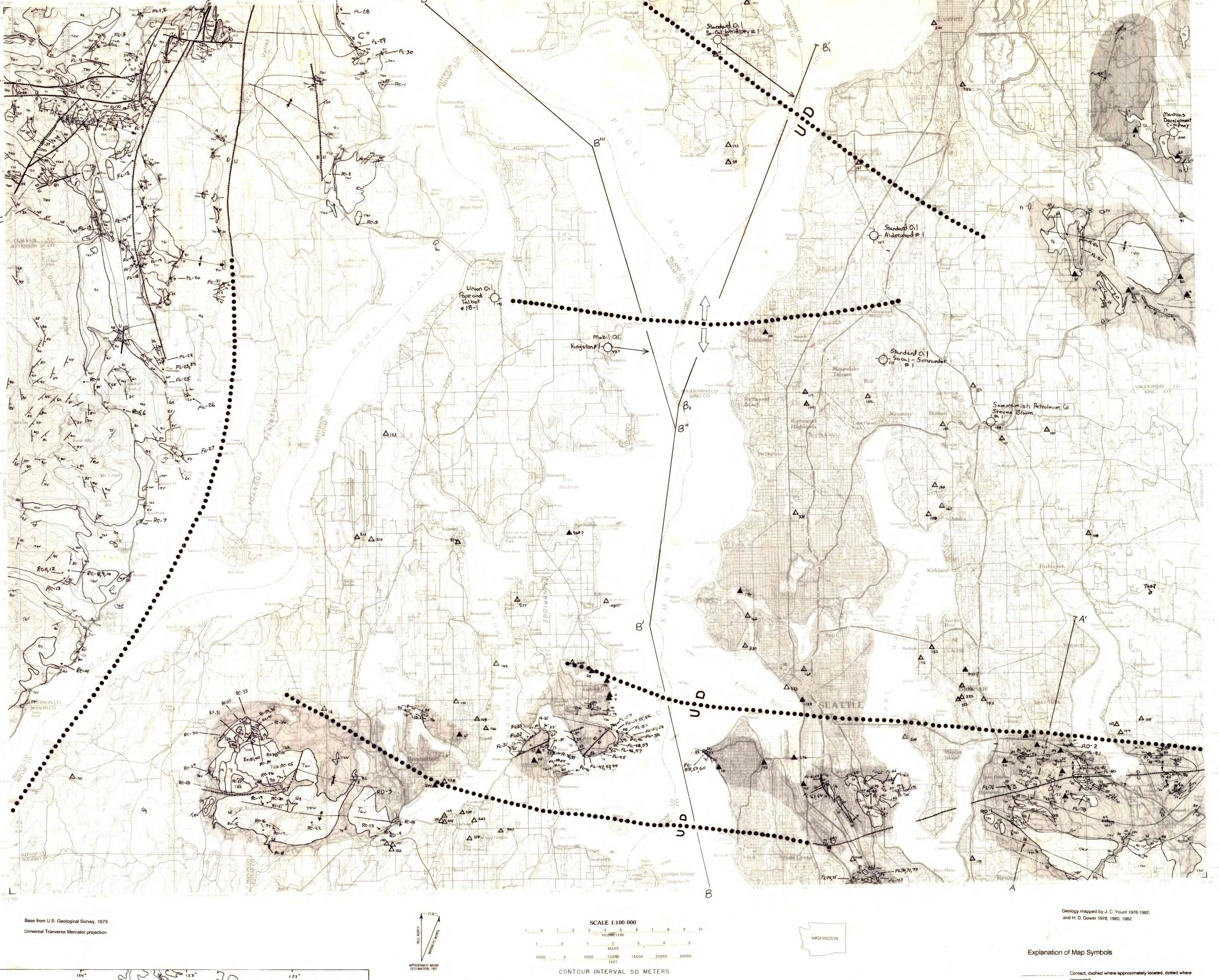
overlying and underlying rocks contain late Eocene fossils

Ttv Tukwila Formation (Middle and Upper Eocene) -- a ndesitic volcaniclastic rocks, including tuffaceous sandstone and siltstone, conglomerate, tuff, and breccia. Locally includes massive porphyritic andesite intrusives. South of map area along the Duwamish River marine sandstone and siltstone in the lower part of the formation contain foraminifera assigned to the Ulatisian Stage of early and middle Eocene age (Rau, 1980, pers. comm.). Elsewhere, where the formation is nonmarine, it has been assigned a late Eocene age by Wolfe and others (1961). Turner and others (1983) report a fission track age of 41.3 my and an average age from 3 K-Ar determinations of 42.3 my for andesite breccia from the upper part of the formation near Newcastle (Table 1)

## **SNOHOMISH COUNTY**

Ts | Tertiary Sedimentary Rock (Oligocene)--shale, siltstone, sandstone, and pebble conglomerate. Thin coal beds common. Thick to thin bedded and shaley. Dark gray and olive gray to reddish brown and tan. Concretionary weathering and siderite concretions common. Unconformably overlies Tvu. Probably Oligocene in age based on lithologic similarity to Tss and rocks of Bulson Creek to the north which contain Oligocene fossils. Description modified from Minard (1985b)

Tvu Tertiary Volcanic Rocks (Eocene)--intrusive and extrusive mafic volcanic rocks; includes dense aphanitic to fine-grained basalt and coarse-grained gabbro. Volcanic breccia common. Description modified from Minard (1985b)



Index map of Seattle quadrangle within western Washington Olympic Teninsula Individual localities: TM Tiger Mountain DM Des Moines PT Port Townsend BC Bulson Creek QP Quimper Peninsula Mi Marrowstone Island MZ Mount Zion DC Deep Creek LR Lyre River **CB** Crescent Bay **BD** Black Diamond

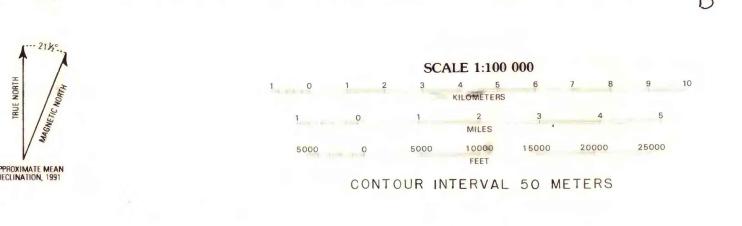
See also inset map for

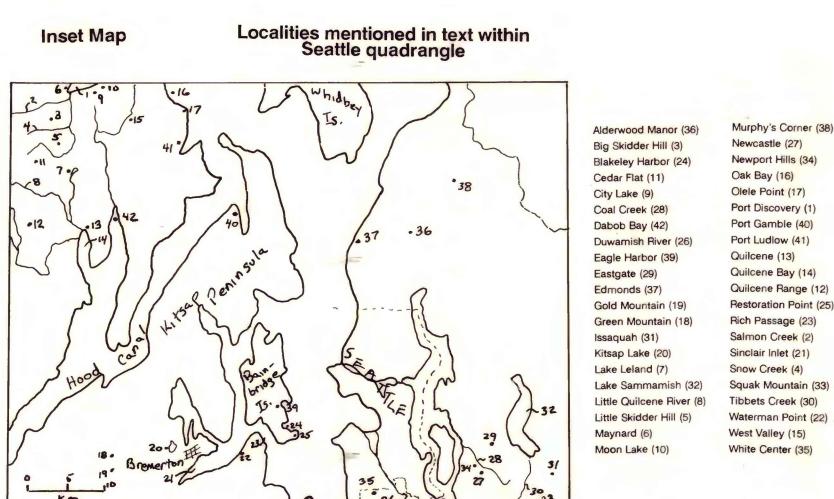
additional place names used in this report

A Auburn

R Renton

MP Mount Persis





# BEDROCK GEOLOGIC MAP OF THE SEATTLE 30' BY 60' QUADRANGLE, WASHINGTON

James C. Yount and Howard D. Gower

1991

Area where Tertiary rock lies within 100 m of ground surface. Shown only east of Hood Canal

High-angle fault, dashed where approximately located; D, down;

Anticline, arrow along axis shows direction of plunge

Landslide, arrows show direction of movement

cross section; located from Livingston, 1958

rock encountered (open)

Location of fossiliferous sample (see Table 2)

Rc-1 - Location of rock chemistry sample (see Table 3)

Oil well, number indicates depth below ground surface to Tertiary

rock, in meters. Arrow indicates projection of subsurface data to

Water or geotechnical well, number indicates depth to Tertiary

Location of radiometrically dated rock sample (see Table 1)

rock (solid) or thickness of Quaternary sediment with no Tertiary

Fold Axes, dotted where concealed

Faults and Folds Inferred From Geophysical Data

Fault; D, down; U, up

Strike and Dip of Bedding

> Vertical

Anticline

This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by